

Feeding the Canine Athlete for Optimal Performance

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The veterinary profession is currently witnessing an increased demand from our clientele for information concerning performance of the canine athlete. The expectations come as a result of the scientific advancements in human sports medicine. If a pet owner is only interested in companionship, minimal stress will be placed upon the pet's body. As the athletic demands of the owner increase there is a proportional increase in the physical demands placed upon the animal's body. A certain level of energy is needed to maintain homeostasis, and additional energy is utilized during physical activity. Designing the proper nutritional program begins by defining the type of activity and then the level of activity the dog will be asked to perform. Once the activity requirements are determined, the components of the daily feeding regimen can be formulated. In addition, supplementation can be utilized to address additional energy requirement needed by the different activities. A professional and informed approach to feeding can enhance performance and minimize problems that can result in poor performance.

Activity Type and Level

The body needs energy to maintain homeostasis, and additional energy during physical activity. The maintenance energy requirement (MER) is defined as the energy used by a moderately active adult dog in a thermoneutral environment (MER=30 kcal/# for a 50+ pound dog). When the body performs at a level greater than its normal daily routine there is a greater for energy. Physical activities can be divided into two categories: strength/power activities and endurance activities. Strength/power events are of short duration (< 2 minutes) and are performed at intensities that are maximal or supramaximal. Some events are intermediate, they are performed at varying intensities for a duration of 2-4 minutes. Endurance events usually last longer than four minutes and are performed at intensities < 90% of maximal aerobic power (VO₂ max). It is estimated that a dog hunting for one hour utilizes 1.1 x MER, a full day of hunting utilizes 1.4-1.5 x MER, and a sled dog pulling for one day uses 2-4 x MER.

The body utilizes three systems to provide energy for the body. The type of activity defines which of the systems will be used. The immediate energy source is from the one enzyme system. It provides energy for the first five to twenty seconds. This system uses intracellular ATP, Creatine Phosphate (CP), and the ADP/myokinase reaction to provide energy for increased body activity. The glycolytic energy pathway provides energy from five to twenty seconds up to two minutes. Energy comes from the anaerobic breakdown of glucose. This is a more complicated form of energy production involving multiple steps and enzymes. The third energy source is from oxidative metabolism. It starts approximately two minutes after the start of the physical exercise. It is the most complicated energy system. It can use various substrates and is the most efficient energy

system. Strength/power activities rely heavily upon the one enzyme and the glycolytic energy systems, and endurance activities rely upon the oxidative energy systems.

Nutritional Components

The three energy sources used by the body are carbohydrates, proteins, and fats. Digestible carbohydrates are the sugars and the starches. Cellulose, pectin, and gums are the carbohydrates that are termed fibers and are minimally digestible. The simple sugars, called monosaccharides, are glucose, fructose, and galactose. These carbohydrates are in the smallest form and do not need to be broken down to be absorbed by the intestine. The disaccharides are sucrose, maltose, and lactose and are compounds composed of two of the simple sugars. The starches are complex carbohydrates, polysaccharides, that are long chains composed of the simple sugars. Disaccharides and polysaccharides need to be broken down enzymatically to be absorbed by the intestine. Carbohydrates have an energy yield of 3.5 kcal per gram.

Protein is both an energy source and a source of amino acids. High-quality animal source proteins provide superior digestibility, amino acid balances, and palatability. Exercise increases an athlete's protein requirement. Exercise places excess demands upon the body which result in tissue disruption and occasionally tissue damage. These tissues must be remodeled and repaired which can result in an increased protein demand. This demand can be met by increased protein ingestion. Protein can also be used for an energy source with an energy yield of 3.5 kcal per gram.

Fat is used by the body for energy and can be used as a metabolic water source. Fats are highly digestible, very palatable, and are an energy dense nutritional ingredient. It has an energy yield of 8.5 kcal per gram. They are also essential for the absorption of the fat soluble vitamins, A, D, E, and K. Fat provides a source of metabolic water. Fat metabolism produces 107 g of water for every 100 grams of fat. Protein produces 40g water/100g protein, and carbohydrate produces 55g water/100 g carbohydrate. Fatty acid ratio can also help to reduce the production of inflammatory mediators in canine skin, plasma, and neutrophils. Dietary omega-6:omega-3 fatty acid ratios between 5:1 and 10:1 are optimum.

Vitamins and minerals are also very important in the canine athlete. Some important vitamins are A, D, E, K, and the B-complex vitamins, especially thiamin, niacin, and cyanocobalamin (B1, B3, and B12). Vitamin A plays a role in ligament and tendon health. Vitamin D is important in maintaining the calcium and phosphorus balance. Vitamin E is a very important anti-oxidant. It acts to maintain cell membrane stability, which is very important in dogs that use their olfactory senses, i.e. pointing breeds, detector dogs, and search and rescue dogs. Vitamin K is important to maintain proper blood conditions in the canine athlete. Thiamin helps to minimize the effects of stress related to competition and performance. Niacin aids in carbohydrate metabolism, and is required for red blood cell production. Cyanocobalamin is essential for synthesis of protein and formation of red blood cells and hemoglobin. Most vitamin needs are met

with a normal high quality diet, but in certain situations supplementation can be beneficial to performance.

Nutritional Program Design

Sprint athletes utilize the one enzyme system and the glycolytic energy system. The duration of their activity does not last long enough to access energy from the oxidative energy system. Their base diet should include a high percentage of carbohydrates and protein. Some of these diets are currently manufactured or carbohydrate sources can be added to a traditional high protein diet. If the competition involves many repetitive sprints or activities the body will at some point begin using energy from the oxidative system. In these cases a better diet would include a balance of carbohydrates, protein, and fat energy sources. The increase in fat content would provide energy for the later activities.

Endurance athletes are much more dependent upon the oxidative energy systems. These athletes would benefit from a higher percentage of fat in their diet. Some manufactured diets are balanced in this way or a fat based supplement can be added to their normal diet. When the body is burning fat for its energy source it delays muscle glycogen depletion. This action then delays the deleterious effects of fatigue. It has also been shown that burning fat is metabolically cooler than burning protein. Minimizing the increase in body temperature would be beneficial to dogs working in endurance events. This is especially true for dogs working in warmer environments.

*** An important note is that it takes four to six weeks for the body to condition itself to benefit from any diet alterations. This is especially true when increasing the fat content. For example, the hunting dog must begin adding the fat supplement at least four to six weeks prior to the beginning of the hunting season. Also, to benefit from the diet change at the beginning of the hunting season, a conditioning or training program must begin at this same time the diet change is initiated to train the body systems to utilize the supplement. ***

Supplementing with vitamins and minerals can enhance performance. Supplement timing is the key factor when influencing performance. Simple sugar carbohydrates, proper protein, combined with the applicable vitamins and minerals can be given at key times around the event to benefit performance. These will be discussed in greater detail in subsequent articles.

Summary

The veterinarian should discuss the expectations of the owner, and determine exactly what demands are being placed upon their dog. Once the activities are determined, a proper nutritional program can be designed to provide the amount and type of energy that is needed to maximize performance.